WHAT IS CLAIMED IS:

1. A process for synthesizing a substantially single diastereomeric form of an inositolphospholipid, wherein said inositolphospholipid has the target phosphatidyl-*myo*-inositol structure:

1D-1-(1-fattyacyl^1-2-fattyacyl^2-*sn*-glycero-3-phospho)-*myo*-inositol;
1D-1-(3-fattyacyl^1-2-fattyacyl^2-*sn*-glycero-1-phospho)-*myo*-inositol;
1L-1-(1-fattyacyl^1-2-fattyacyl^2-*sn*-glycero-3-phospho)-*myo*-inositol;
1L-1-(3-fattyacyl^1-2-fattyacyl^2-*sn*-glycero-1-phospho)-*myo*-inositol;

wherein fattyacyl^1 and fattyacyl^2 are identical or non-identical;

said process comprising the steps of:

(a) obtaining a lipid synthon, wherein said lipid synthon is a substantially pure enantiomeric form of 1-fattyacyl^1-2-fattyacyl^2-*sn*-glycero-3-phosphoric acid or 3-fattyacyl^1-2-fattyacyl^2-*sn*-glycero-1-phosphoric acid;

(b) obtaining a *myo*-inositol synthon, wherein said *myo*-inositol synthon is a substantially pure enantiomeric form of a selectively partially *O*-protected 1D-1-*myo*-inositol, wherein at least the 1-equatorial hydroxyl is free, the 3-hydroxyl and at least three other hydroxyls carry temporary *O*-protecting groups;

(c) reacting said lipid synthon with said *myo*-inositol synthon in the presence of a phosphoric group activating reagent system, thereby linking the two synthons by a phosphodiester bond and creating an *O*-protected derivative of the target phosphatidyl-*myo*-inositol as an intermediate; and

(d) subjecting said *O*-protected intermediate to a deprotection process to completely remove the protecting groups, thereby forming the target phosphatidyl-*myo*-inositol diastereomer.

2. The process of claim 1, further comprising subjecting said target phosphatidyl-*myo*-inositol diastereomer to purification to eliminate non-phosphatidyl-*myo*-inositol contaminants.

3. The process of claim 1, wherein said inositolphospholipid has the target phosphatidyl-*myo*-inositol structure 1D-1-(1-fattyacyl^1-2-fattyacyl^2-*sn*-glycero-3-phospho)-*myo*-inositol or 1D-1-(3-fattyacyl^1-2-fattyacyl^2-*sn*-glycero-1-phospho)-*myo*-inositol.

4. The process of claim 1, wherein said inositolphospholipid has the target phosphatidyl-*myo*-inositol structure 1L-1-(1-fattyacyl^1-2-fattyacyl^2-*sn*-glycero-3-phospho)-*myo*-inositol or 1L-1-(3-fattyacyl^1-2-fattyacyl^2-*sn*-glycero-1-phospho)-*myo*-inositol.

5. The process of claim 1, where said target phosphatidyl-*myo*-inositol comprises a saturated chain lipid.

6. The process of claim 1, where said target phosphatidyl-*myo*-inositol comprises a lipid chain comprising a functional group with at least one double or triple bond.

7. A substantially single diastereomeric form of an inositolphospholipid prepared by the process of claim 1.

8. A substantially single diastereomeric form of an inositolphospholipid, wherein said inositolphospholipid has the phosphatidyl-*myo*-inositol structure:

1D-1-(1-fattyacyl^1-2-fattyacyl^2-*sn*-glycero-3-phospho)-*myo*-inositol;
1D-1-(3-fattyacyl^1-2-fattyacyl^2-*sn*-glycero-1-phospho)-*myo*-inositol;
1L-1-(1-fattyacyl^1-2-fattyacyl^2-*sn*-glycero-3-phospho)-*myo*-inositol;
1L-1-(3-fattyacyl^1-2-fattyacyl^2-*sn*-glycero-1-phospho)-*myo*-inositol;

wherein fattyacyl^1 and fattyacyl^2 are identical or non-identical; and

said inositolphospholipid has a molar rotation substantially equal to the bench-mark value established for the specific diastereomer structure.